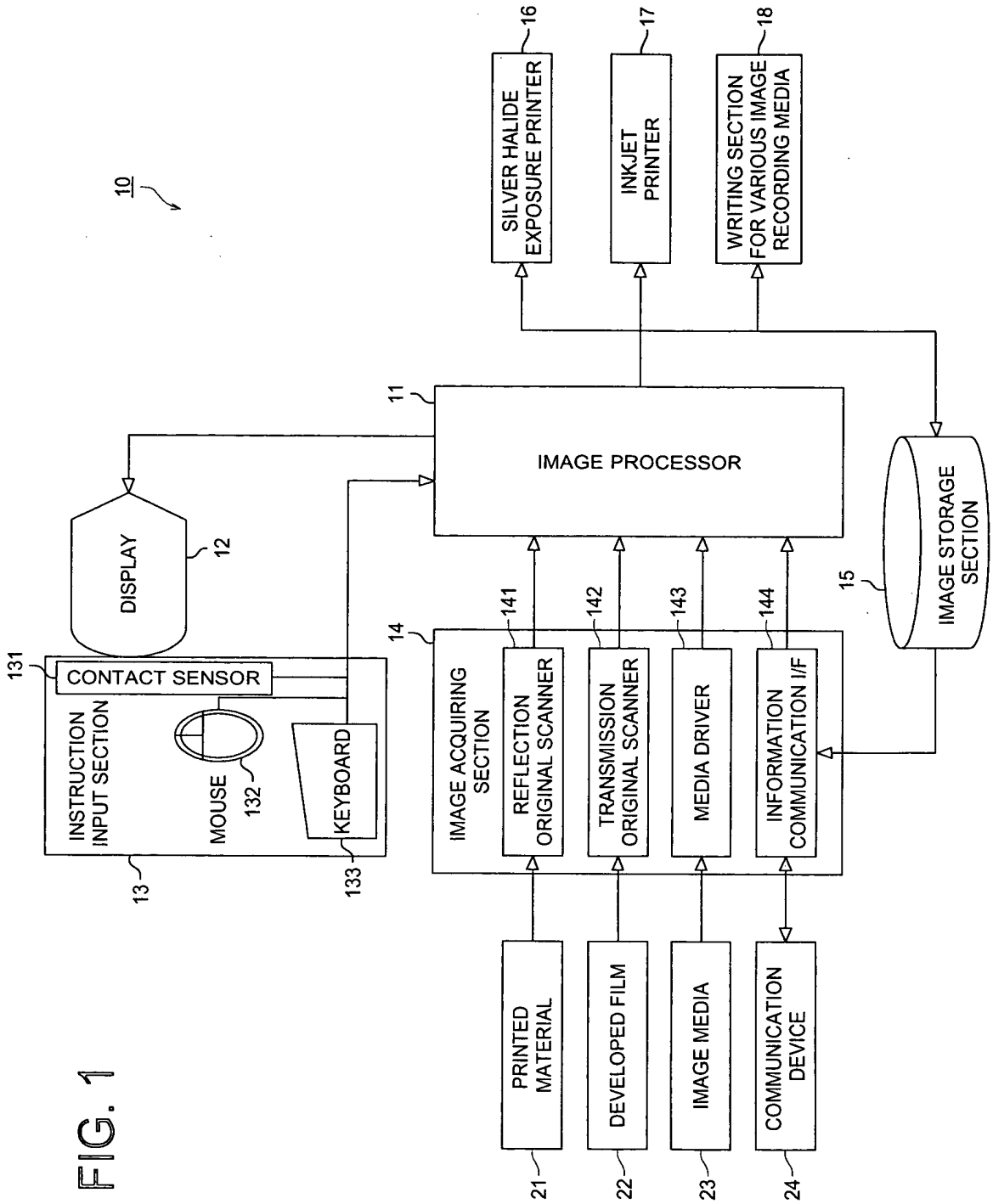

10
SILVER HALIDE EXPOSURE PRINTER
16
INKJET PRINTER
17
WRITING SECTION FOR VARIOUS IMAGE RECORDING MEDIA
18
11
IMAGE PROCESSOR
IMAGE STORAGE SECTION
15
DISPLAY
12
131
CONTACT SENSOR
INSTRUCTION INPUT SECTION
MOUSE
132
KEYBOARD
133
13
14
IMAGE ACQUIRING SECTION
141
REFLECTION ORIGINAL SCANNER
142
TRANSMISSION ORIGINAL SCANNER
143
MEDIA DRIVER
144
INFORMATION COMMUNICATION I/F
PRINTED MATERIAL
21
DEVELOPED FILM
22
IMAGE MEDIA
23
COMMUNICATION DEVICE
24

FIG. 1

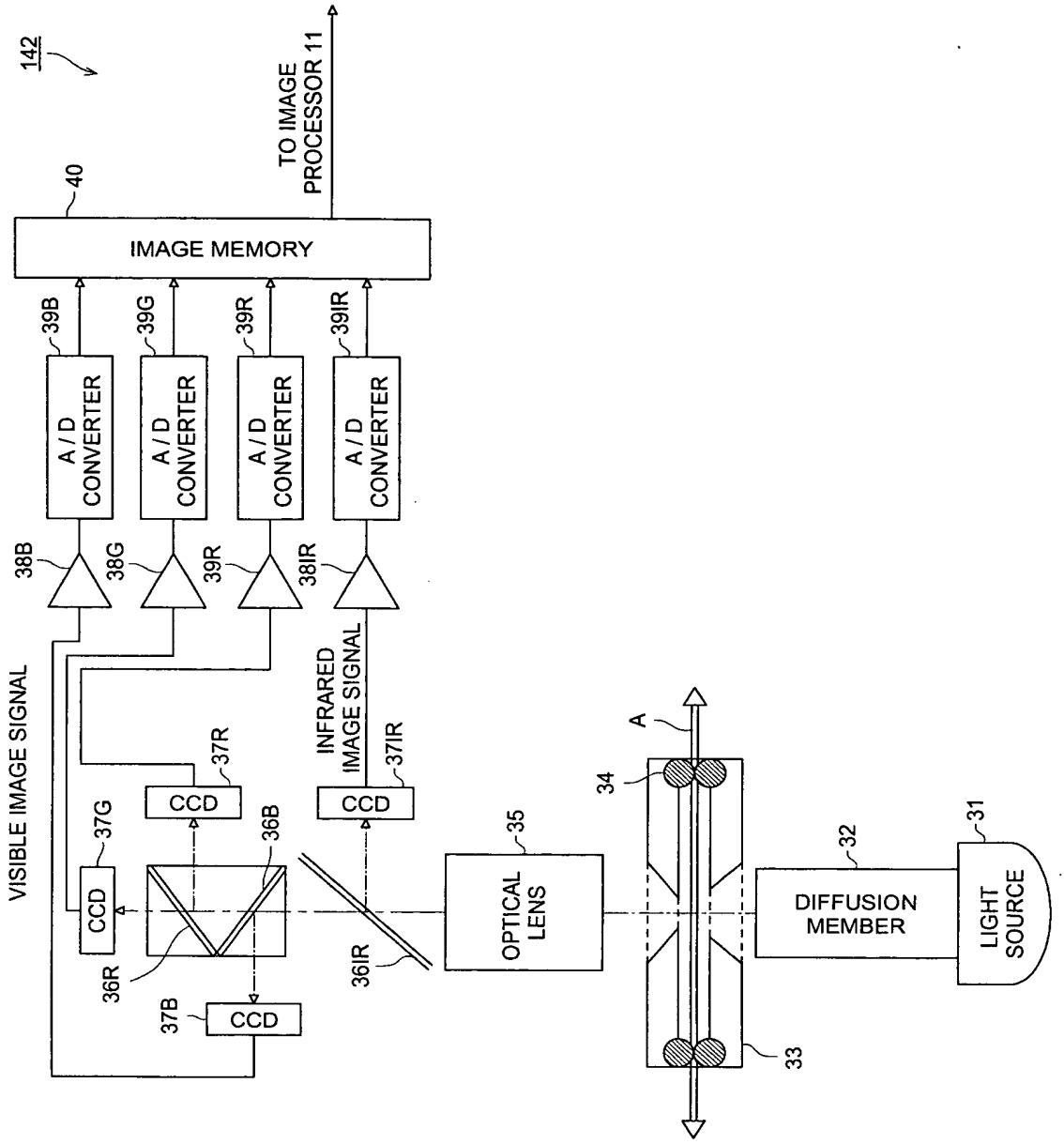

142
TO IMAGE PROCESSOR 11
40
IMAGE MEMORY
39B
39G
39R
39IR
A / D CONVERTER
A / D CONVERTER
A / D CONVERTER
A / D CONVERTER
38B
38G
39R
38IR
VISIBLE IMAGE SIGNAL
INFRARED IMAGE SIGNAL
37R
37IR
CCD
CCD
37G
36B
CCD
36R
37B
CCD
36IR
35
OPTICAL LENS
A
34
33
32
DIFFUSION MEMBER
31
LIGHT SOURCE

FIG. 2

FIG. 3

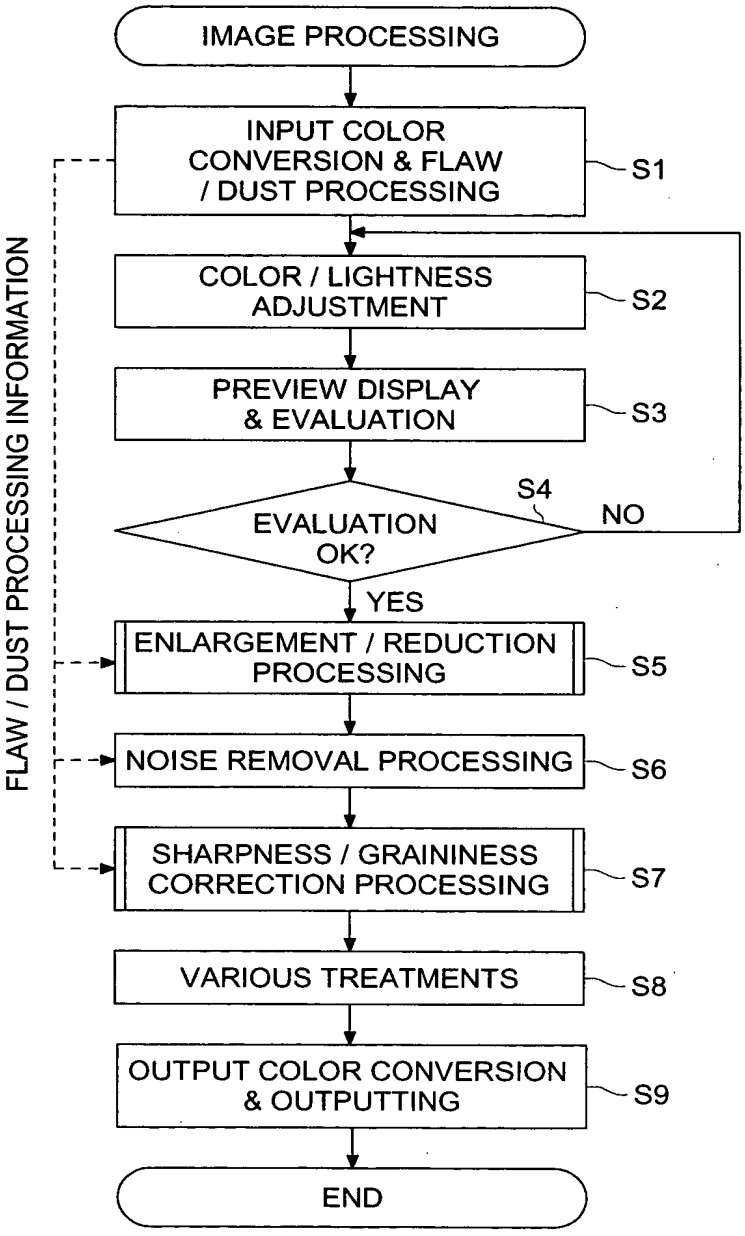


IMAGE PROCESSING
INPUT COLOR CONVERSION & FLAW / DUST PROCESSING
S1
COLOR / LIGHTNESS ADJUSTMENT
S2
PREVIEW DISPLAY & EVALUATION
S3
EVALUATION OK?
S4
NO
YES
ENLARGEMENT / REDUCTION PROCESSING
S5
NOISE REMOVAL PROCESSING
S6
SHARPNESS / GRAININESS CORRECTION PROCESSING
S7
VARIOUS TREATMENTS
S8
OUTPUT COLOR CONVERSION & OUTPUTTING
S9
END
FLAW / DUST PROCESSING INFORMATION

FIG. 4

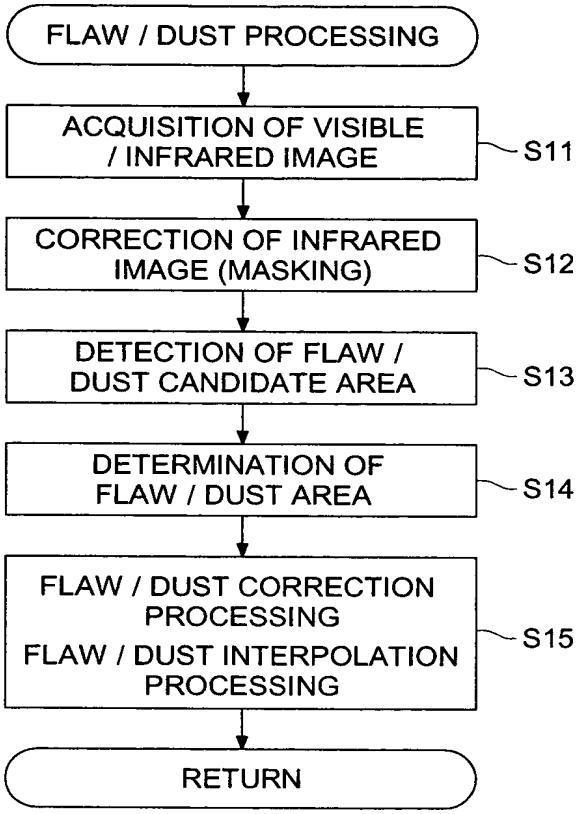

FLAW / DUST PROCESSING
ACQUISITION OF VISIBLE / INFRARED IMAGE
S11
CORRECTION OF INFRARED IMAGE (MASKING)
S12
DETECTION OF FLAW / DUST CANDIDATE AREA
S13
DETERMINATION OF FLAW / DUST AREA
S14
FLAW / DUST CORRECTION PROCESSING
FLAW / DUST INTERPOLATION PROCESSING
S15
RETURN

FIG. 5

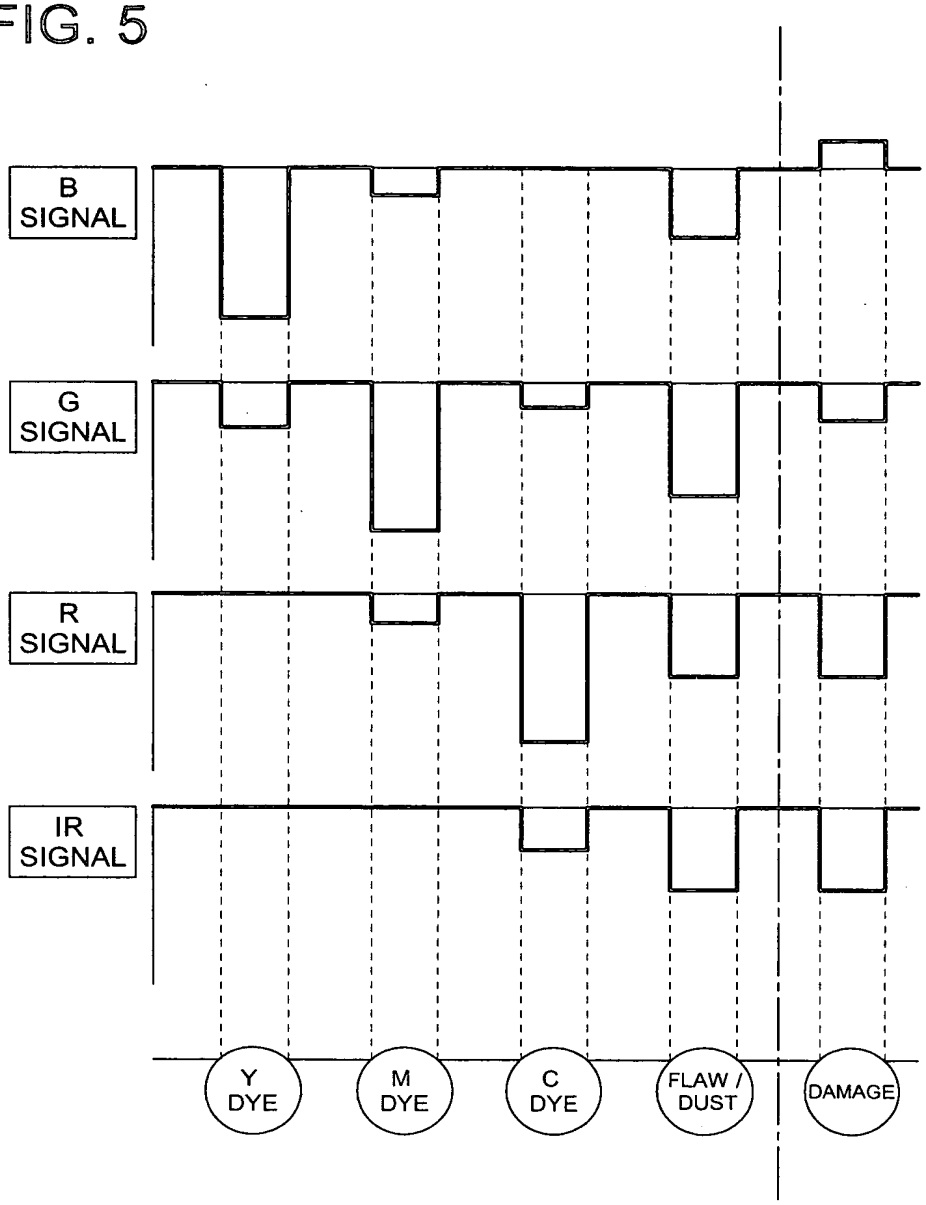

B SIGNAL
G SIGNAL
R SIGNAL
IR SIGNAL
Y DYE
M DYE
C DYE
FLAW / DUST
DAMAGE

FIG. 6

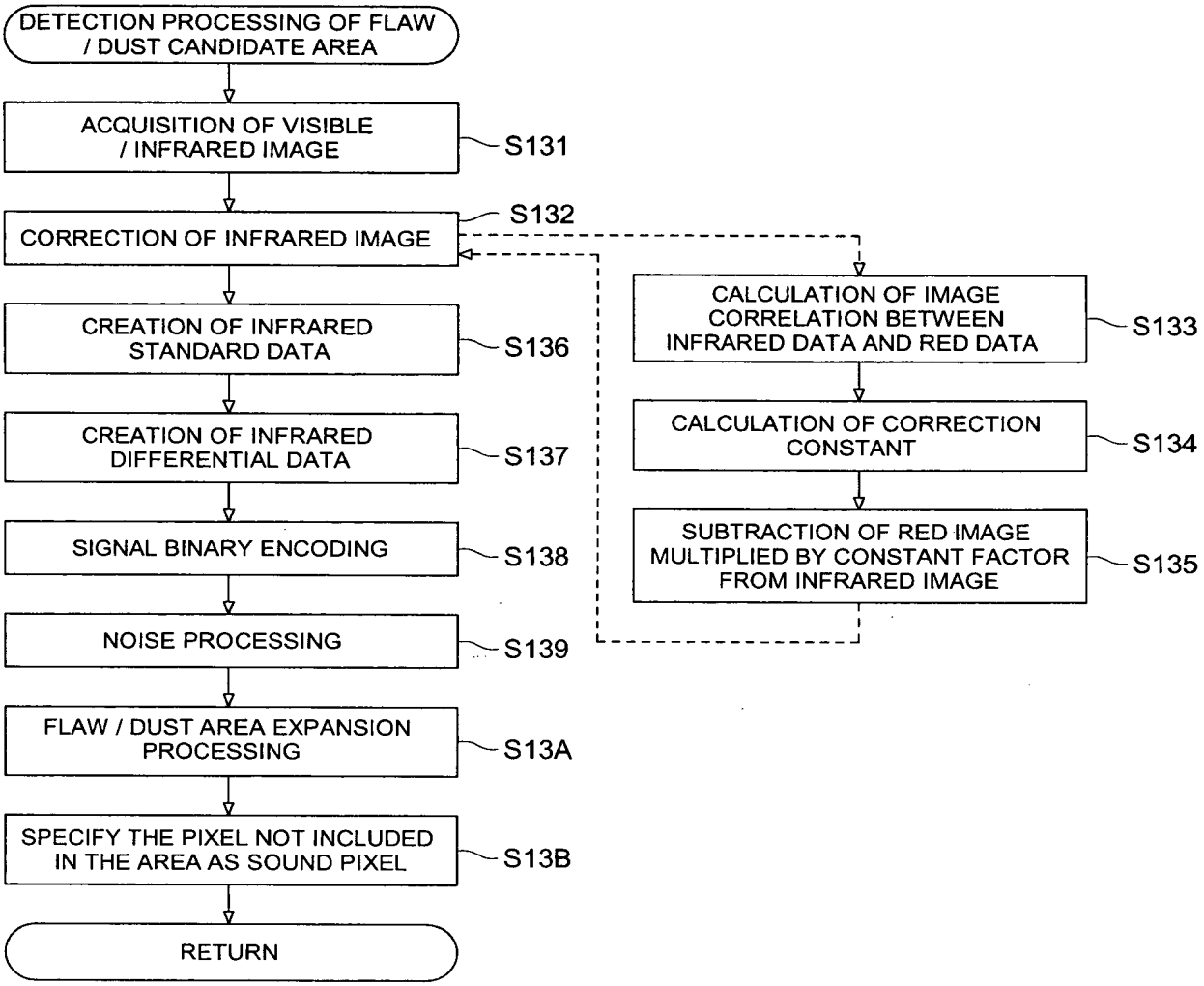

DETECTION PROCESSING OF FLAW / DUST CANDIDATE AREA
ACQUISITION OF VISIBLE / INFRARED IMAGE
S131
CORRECTION OF INFRARED IMAGE
S132
CREATION OF INFRARED STANDARD DATA
S136
CREATION OF INFRARED DIFFERENTIAL DATA
S137
SIGNAL BINARY ENCODING
S138
NOISE PROCESSING
S139
FLAW / DUST AREA EXPANSION PROCESSING
S13A
SPECIFY THE PIXEL NOT INCLUDED IN THE AREA AS SOUND PIXEL
S13B
RETURN
CALCULATION OF IMAGE CORRELATION BETWEEN INFRARED DATA AND RED DATA
S133
CALCULATION OF CORRECTION CONSTANT
S134
SUBTRACTION OF RED IMAGE MULTIPLIED BY CONSTANT FACTOR FROM INFRARED IMAGE
S135

FIG. 7

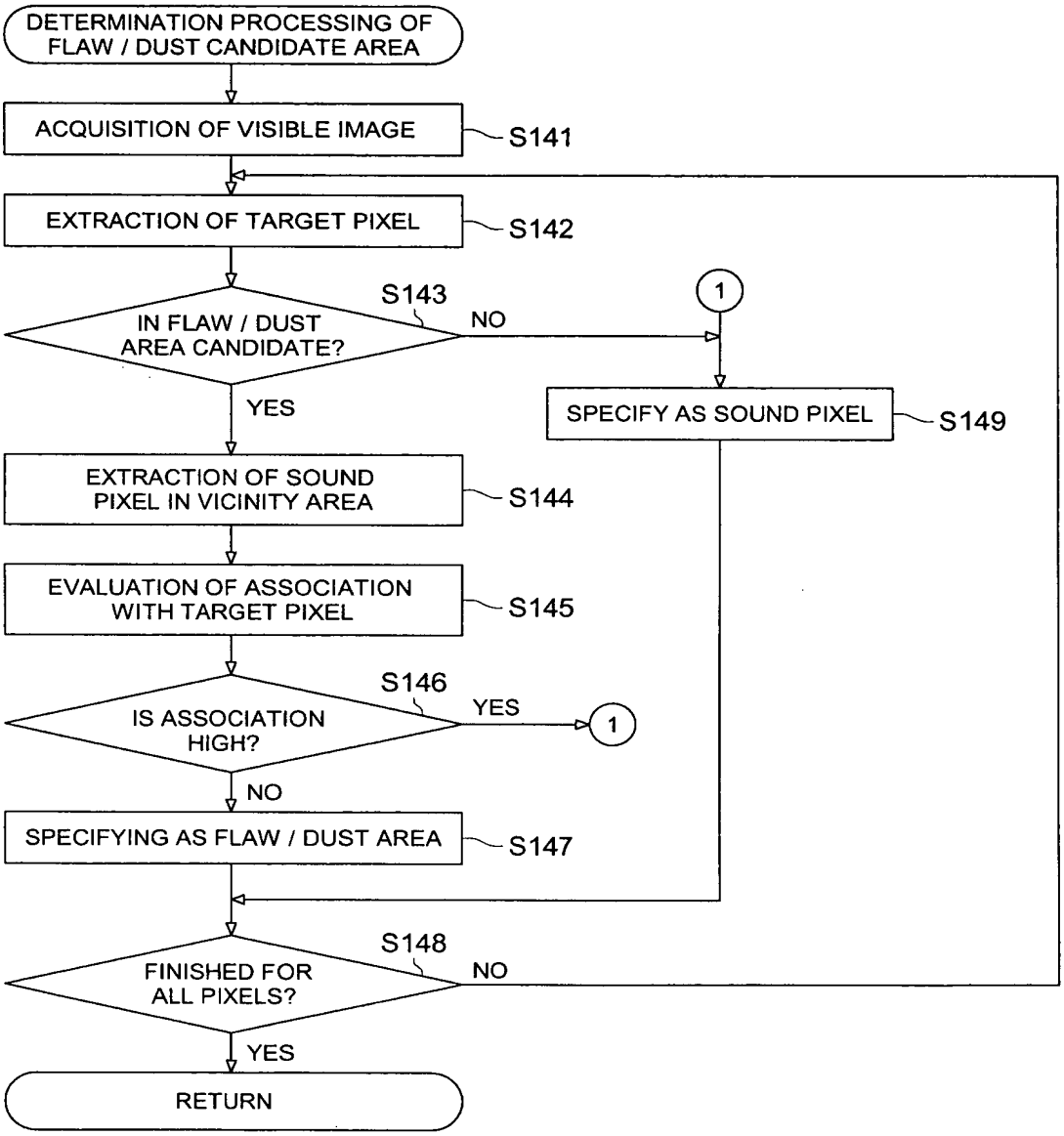

DETERMINATION PROCESSING OF FLAW / DUST CANDIDATE AREA
ACQUISITION OF VISIBLE IMAGE
S141
EXTRACTION OF TARGET PIXEL
S142
S143
IN FLAW / DUST AREA CANDIDATE?
NO
1
SPECIFY AS SOUND PIXEL
S149
YES
EXTRACTION OF SOUND PIXEL IN VICINITY AREA
S144
EVALUATION OF ASSOCIATION WITH TARGET PIXEL
S145
S146
IS ASSOCIATION HIGH?
YES
1
NO
SPECIFYING AS FLAW / DUST AREA
S147
S148
FINISHED FOR ALL PIXELS?
NO
YES
RETURN

FIG. 8

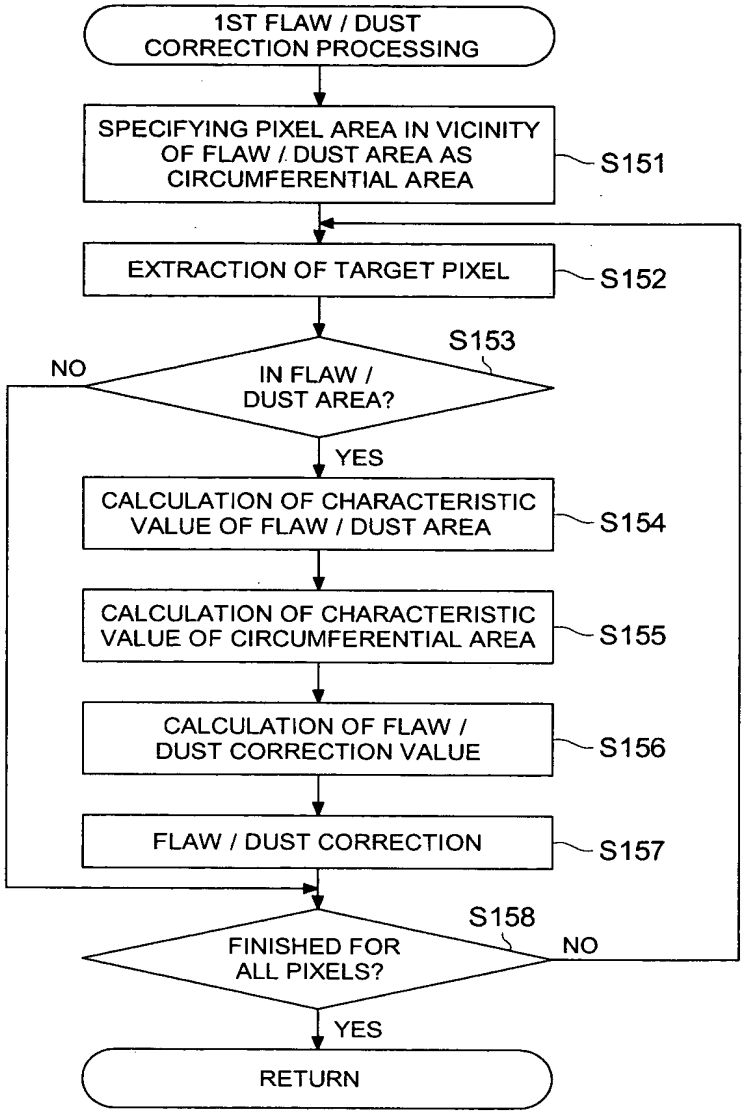
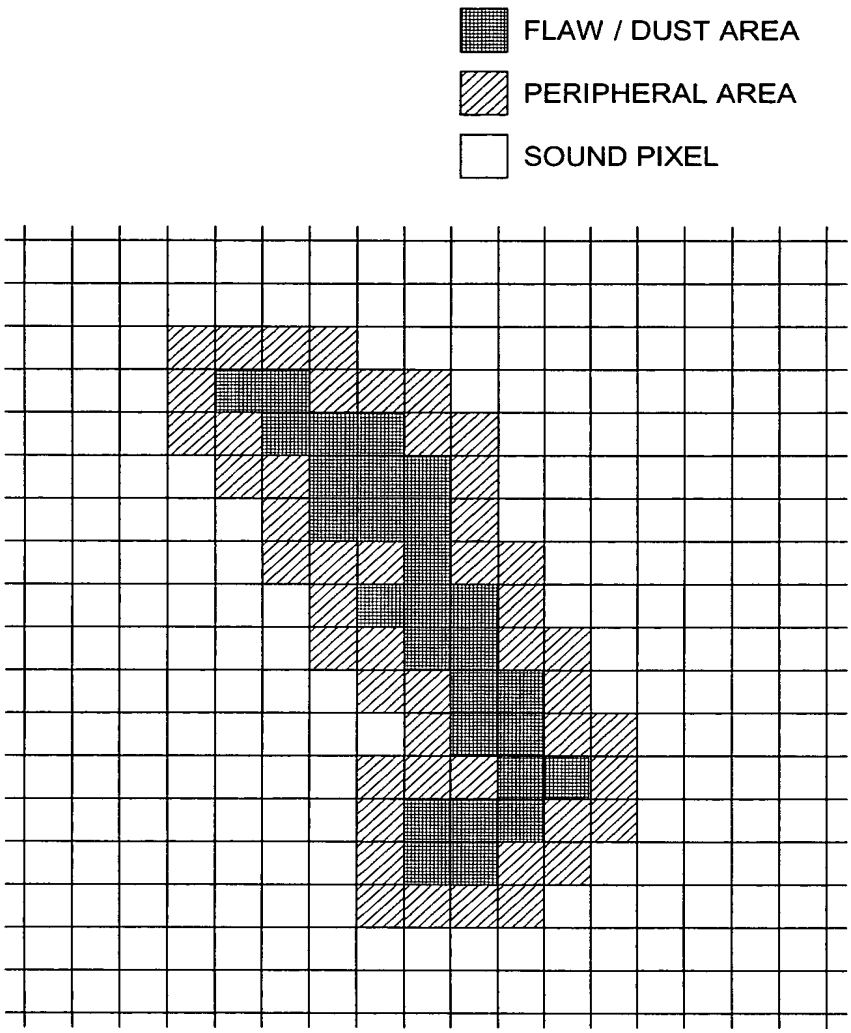

1ST FLAW / DUST CORRECTION PROCESSING
SPECIFYING PIXEL AREA IN VICINITY OF FLAW / DUST AREA AS CIRCUMFERENTIAL AREA
S151
EXTRACTION OF TARGET PIXEL
S152
S153
IN FLAW / DUST AREA?
NO
YES
CALCULATION OF CHARACTERISTIC VALUE OF FLAW / DUST AREA
S154
CALCULATION OF CHARACTERISTIC VALUE OF CIRCUMFERENTIAL AREA
S155
CALCULATION OF FLAW / DUST CORRECTION VALUE
S156
FLAW / DUST CORRECTION
S157
S158
FINISHED FOR ALL PIXELS?
NO
YES
RETURN

FIG. 9



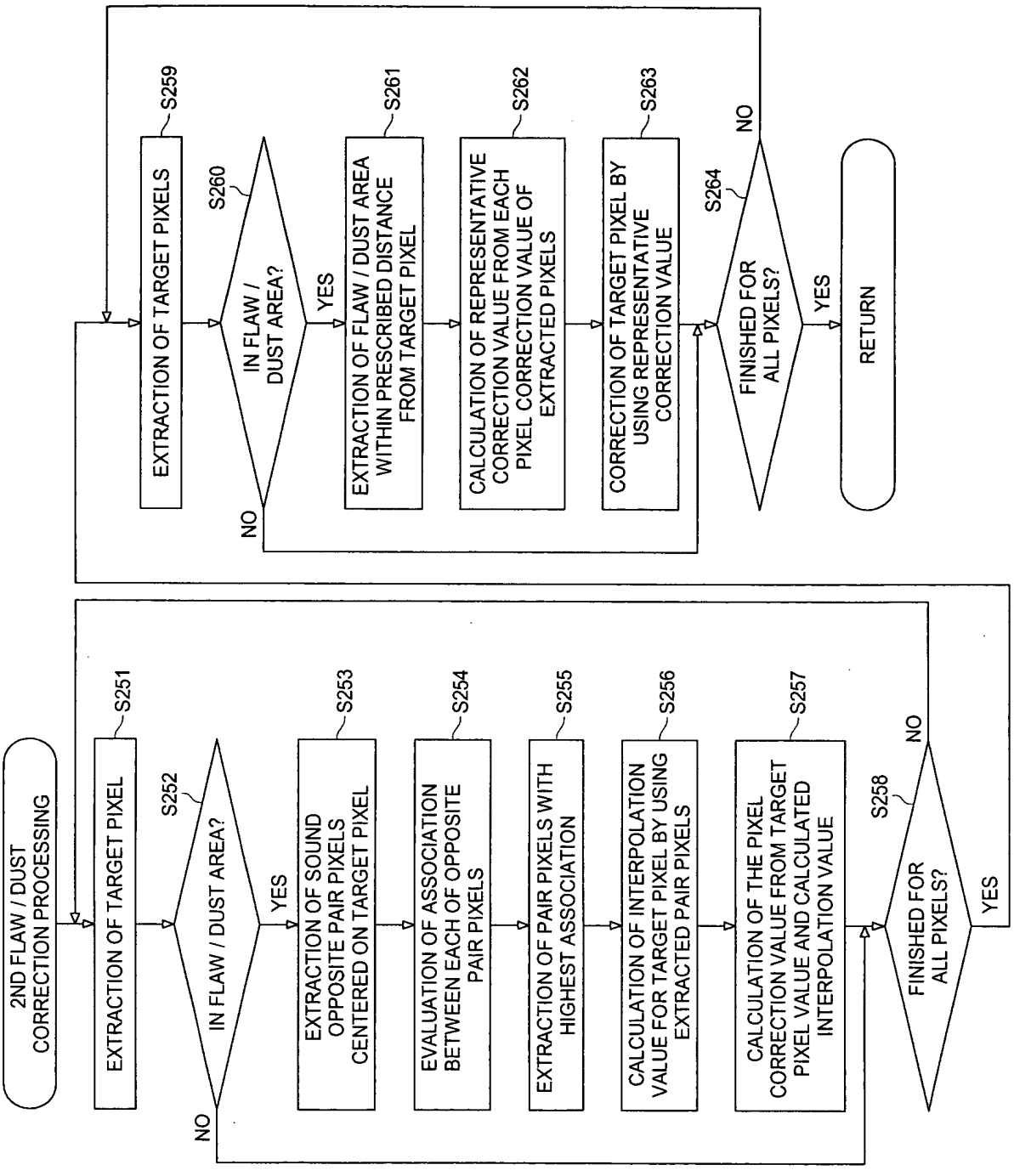

2ND FLAW / DUST CORRECTION PROCESSING
S251
EXTRACTION OF TARGET PIXEL
S252
IN FLAW / DUST AREA?
YES
NO
S253
EXTRACTION OF SOUND OPPOSITE PAIR PIXELS CENTERED ON TARGET PIXEL
S254
EVALUATION OF ASSOCIATION BETWEEN EACH OF OPPOSITE PAIR PIXELS
S255
EXTRACTION OF PAIR PIXELS WITH HIGHEST ASSOCIATION
S256
CALCULATION OF INTERPOLATION VALUE FOR TARGET PIXEL BY USING EXTRACTED PAIR PIXELS
S257
CALCULATION OF THE PIXEL CORRECTION VALUE FROM TARGET PIXEL VALUE AND CALCULATED INTERPOLATION VALUE
S258
FINISHED FOR ALL PIXELS?
NO
YES
S259
EXTRACTION OF TARGET PIXELS
S260
IN FLAW / DUST AREA?
YES
NO
S261
EXTRACTION OF FLAW / DUST AREA WITHIN PRESCRIBED DISTANCE FROM TARGET PIXEL
S262
CALCULATION OF REPRESENTATIVE CORRECTION VALUE FROM EACH PIXEL CORRECTION VALUE OF EXTRACTED PIXELS
S263
CORRECTION OF TARGET PIXEL BY USING REPRESENTATIVE CORRECTION VALUE
S264
FINISHED FOR ALL PIXELS?
NO
YES
RETURN

FIG. 10

FIG. 11

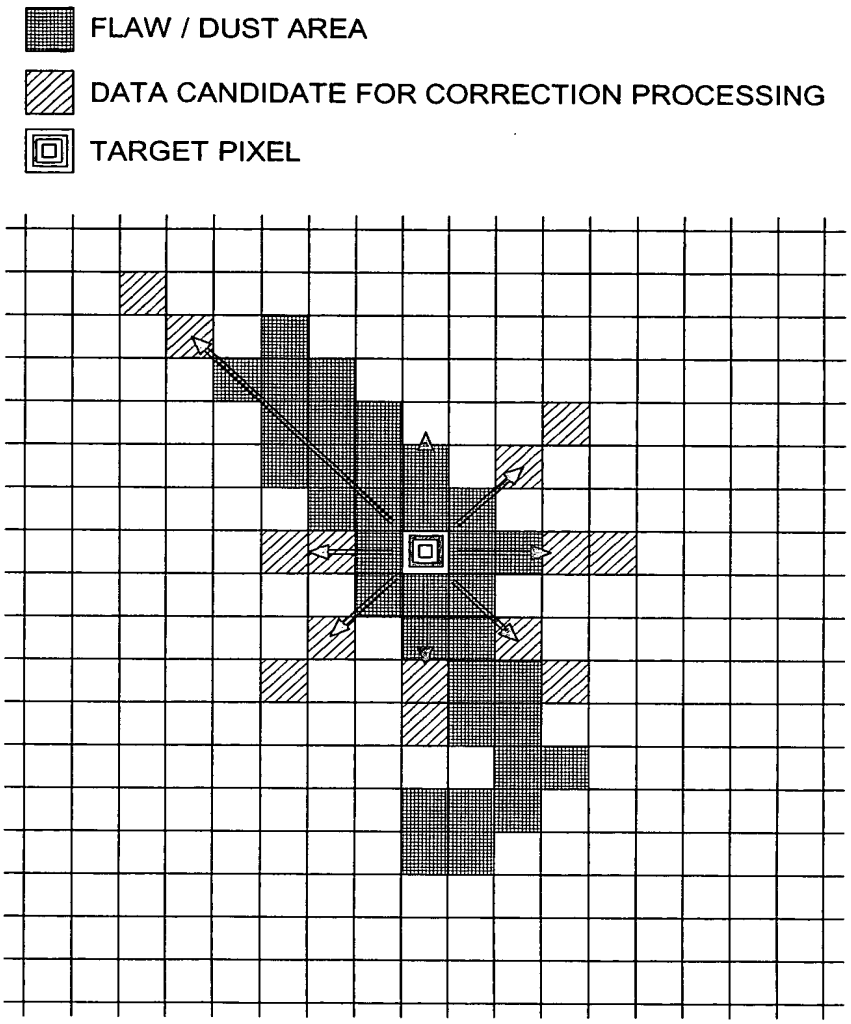

FLAW / DUST AREA
DATA CANDIDATE FOR CORRECTION PROCESSING
TARGET PIXEL

FIG. 12 (a)

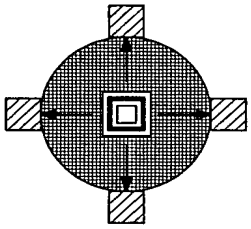


FIG. 12 (b)

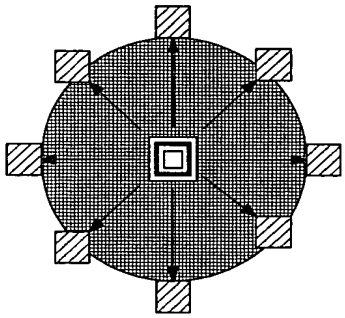


FIG. 12 (c)

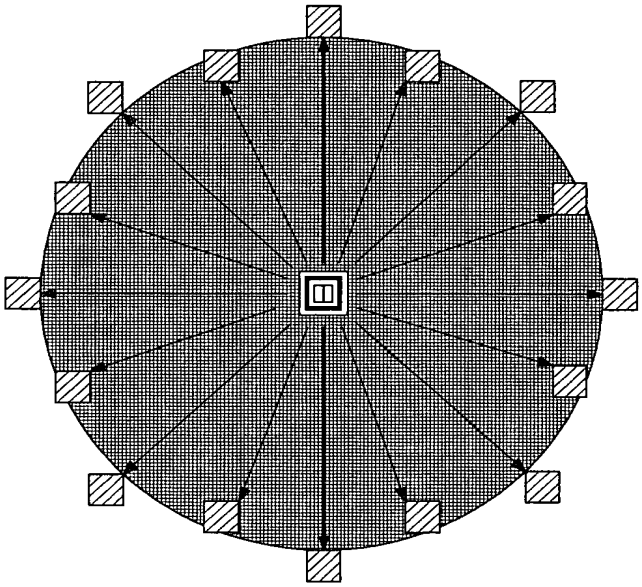


FIG. 13 (a)

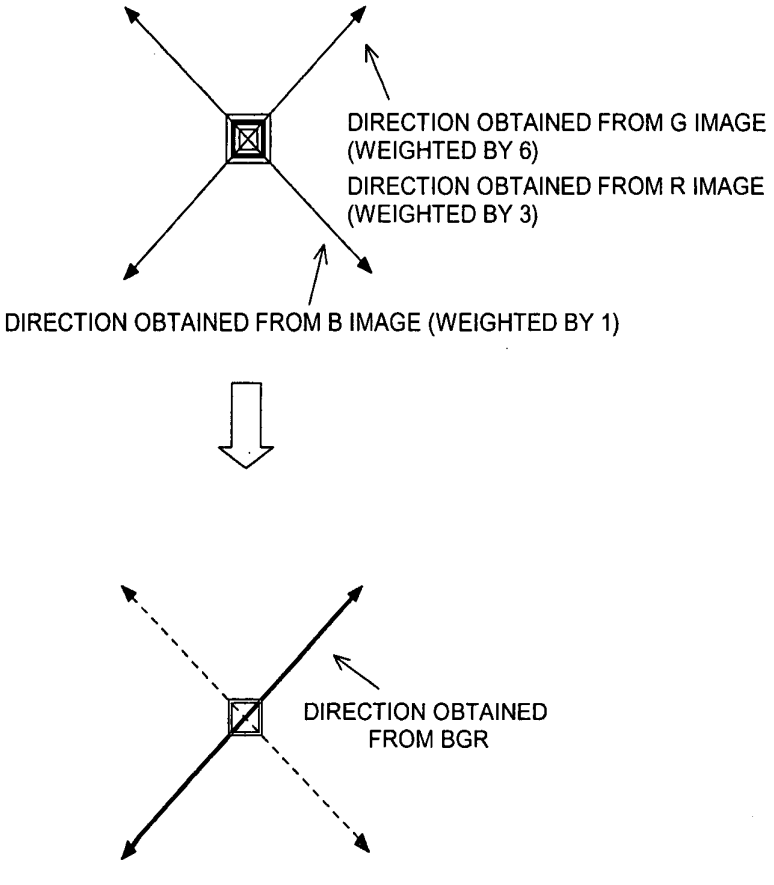
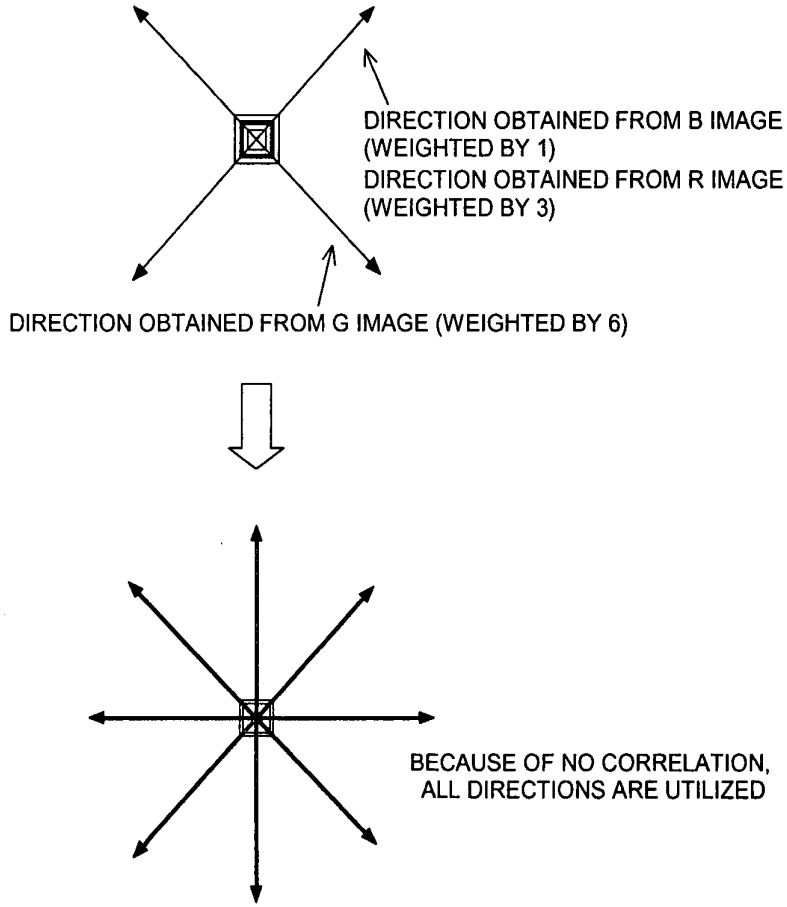


FIG. 13 (b)



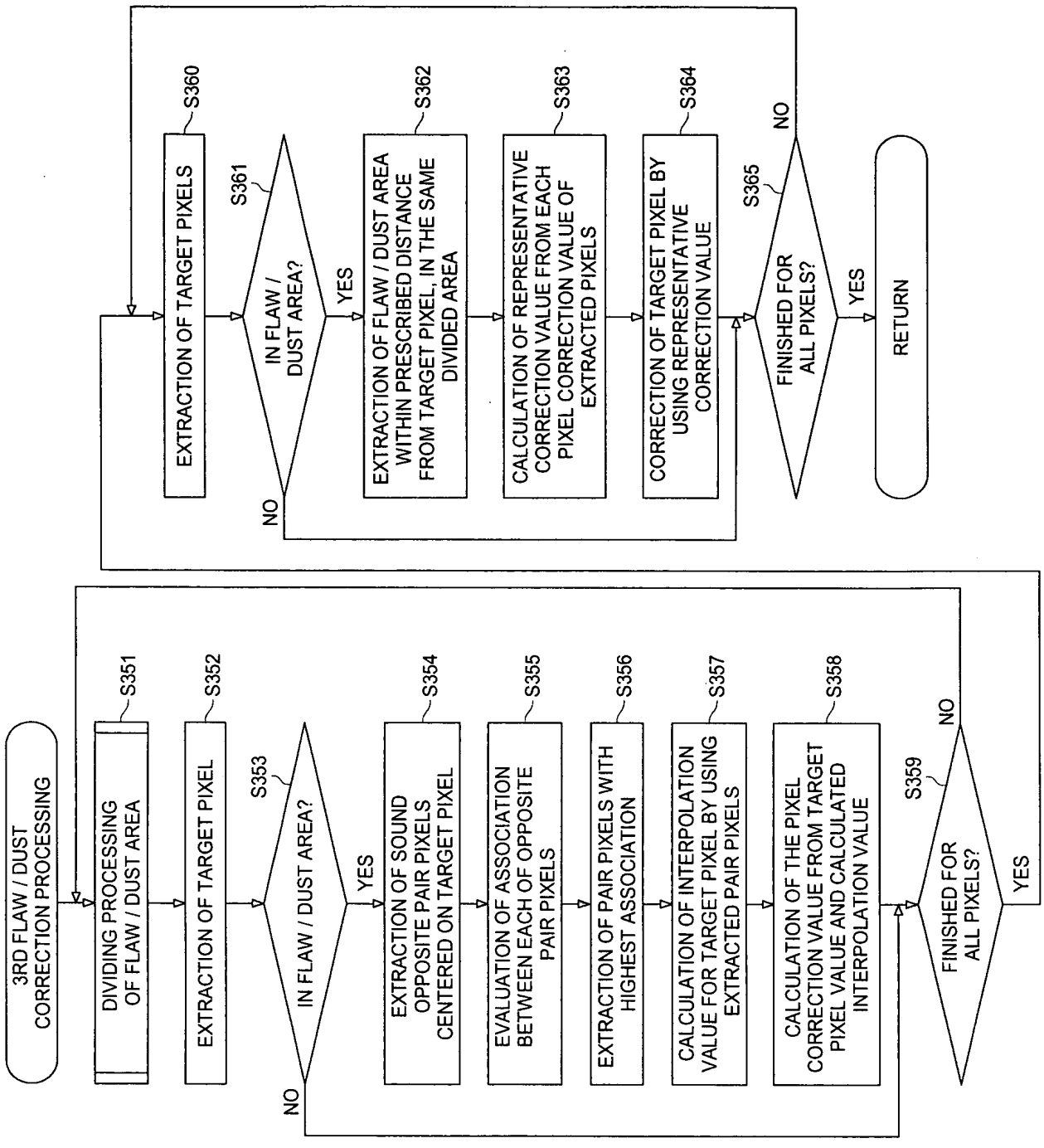

3RD FLAW / DUST CORRECTION PROCESSING
DIVIDING PROCESSING OF FLAW / DUST AREA
S351
EXTRACTION OF TARGET PIXEL
S352
IN FLAW / DUST AREA?
S353
YES
NO
EXTRACTION OF SOUND OPPOSITE PAIR PIXELS CENTERED ON TARGET PIXEL
S354
EVALUATION OF ASSOCIATION BETWEEN EACH OF OPPOSITE PAIR PIXELS
S355
EXTRACTION OF PAIR PIXELS WITH HIGHEST ASSOCIATION
S356
CALCULATION OF INTERPOLATION VALUE FOR TARGET PIXEL BY USING EXTRACTED PAIR PIXELS
S357
CALCULATION OF THE PIXEL CORRECTION VALUE FROM TARGET PIXEL VALUE AND CALCULATED INTERPOLATION VALUE
S358
FINISHED FOR ALL PIXELS?
S359
NO
YES
EXTRACTION OF TARGET PIXELS
S360
IN FLAW / DUST AREA?
S361
YES
NO
EXTRACTION OF FLAW / DUST AREA WITHIN PRESCRIBED DISTANCE FROM TARGET PIXEL, IN THE SAME DIVIDED AREA
S362
CALCULATION OF REPRESENTATIVE CORRECTION VALUE FROM EACH PIXEL CORRECTION VALUE OF EXTRACTED PIXELS
S363
CORRECTION OF TARGET PIXEL BY USING REPRESENTATIVE CORRECTION VALUE
S364
FINISHED FOR ALL PIXELS?
S365
NO
YES
RETURN

FIG. 14

FIG. 15

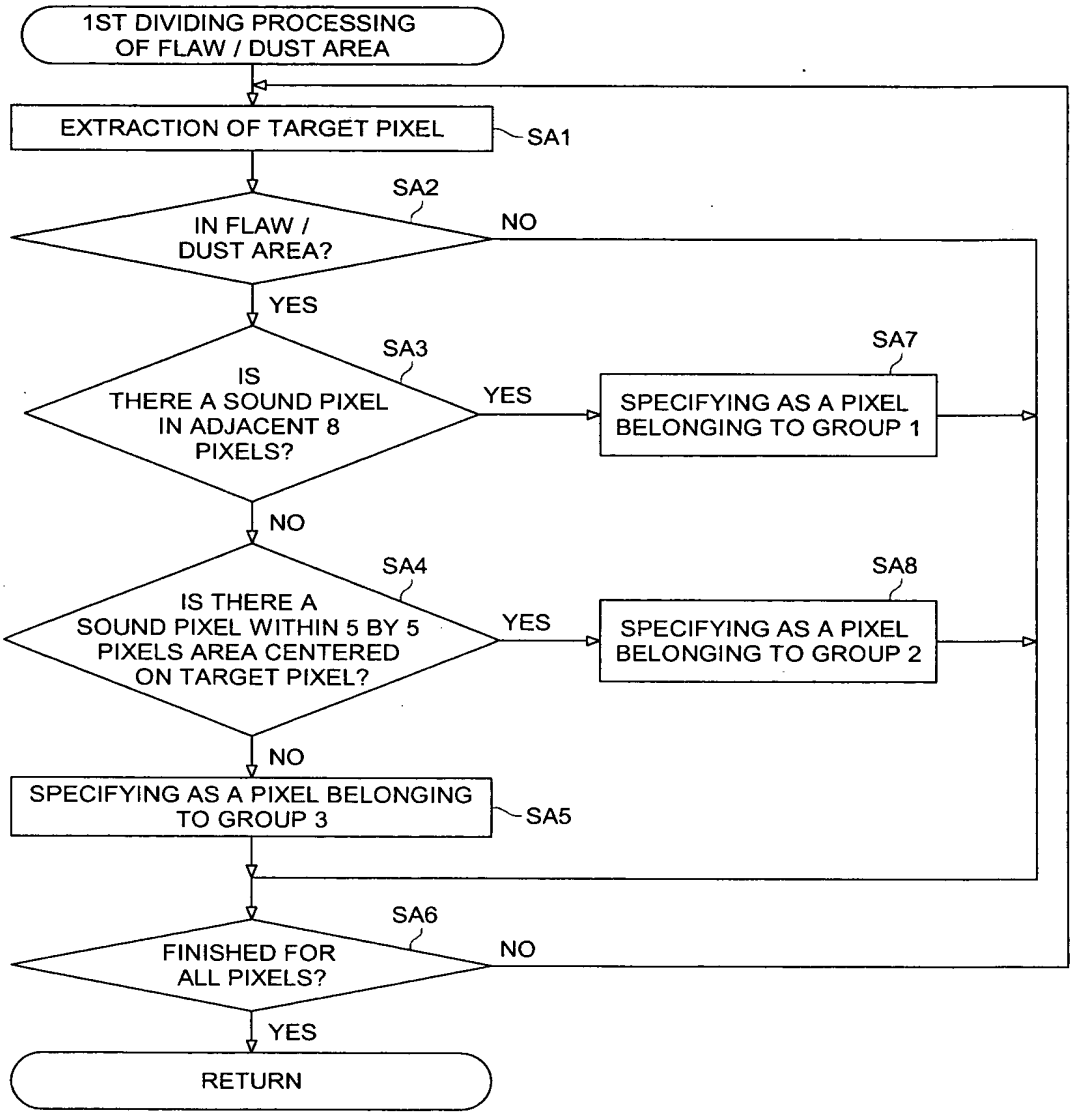

1ST DIVIDING PROCESSING OF FLAW / DUST AREA
EXTRACTION OF TARGET PIXEL
SA1
SA2
IN FLAW / DUST AREA?
NO
YES
SA3
IS THERE A SOUND PIXEL IN ADJACENT 8 PIXELS?
YES
SA7
SPECIFYING AS A PIXEL BELONGING TO GROUP 1
NO
SA4
IS THERE A SOUND PIXEL WITHIN 5 BY 5 PIXELS AREA CENTERED ON TARGET PIXEL?
YES
SA8
SPECIFYING AS A PIXEL BELONGING TO GROUP 2
NO
SPECIFYING AS A PIXEL BELONGING TO GROUP 3
SA5
SA6
FINISHED FOR ALL PIXELS?
NO
YES
RETURN

FIG. 16

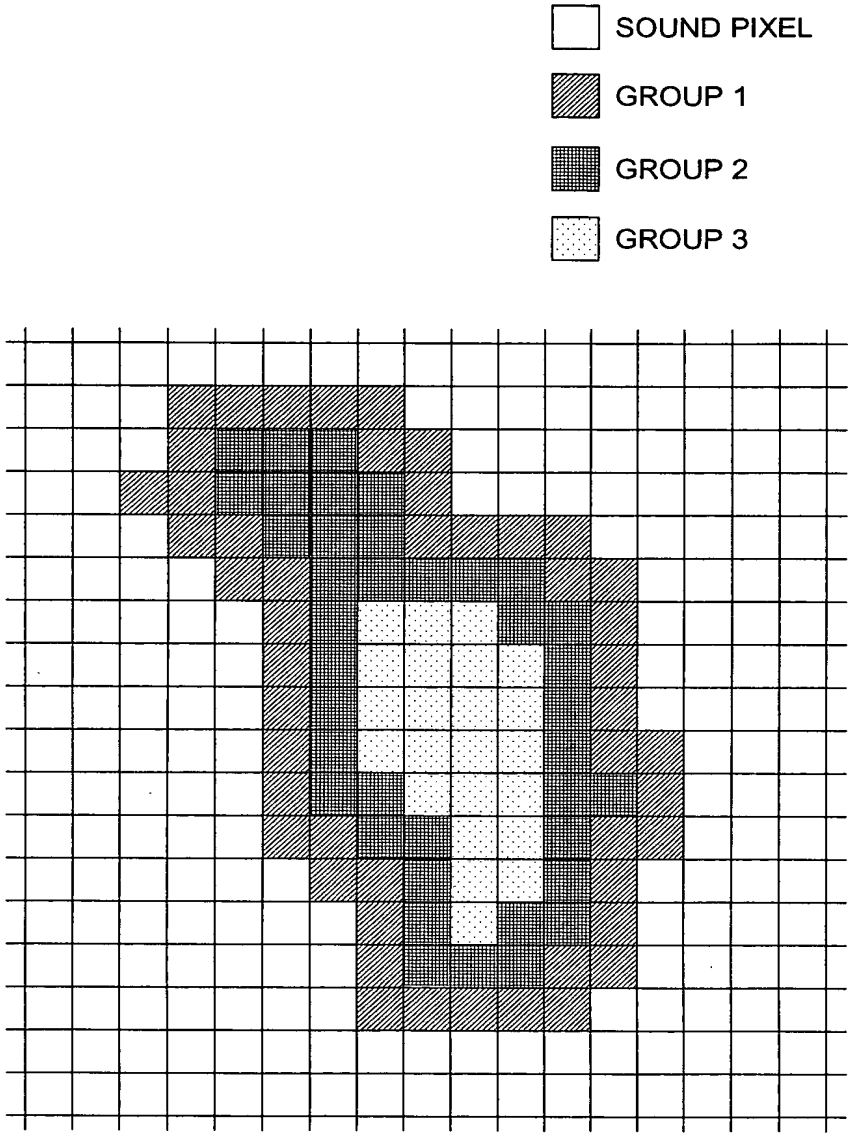


FIG. 17

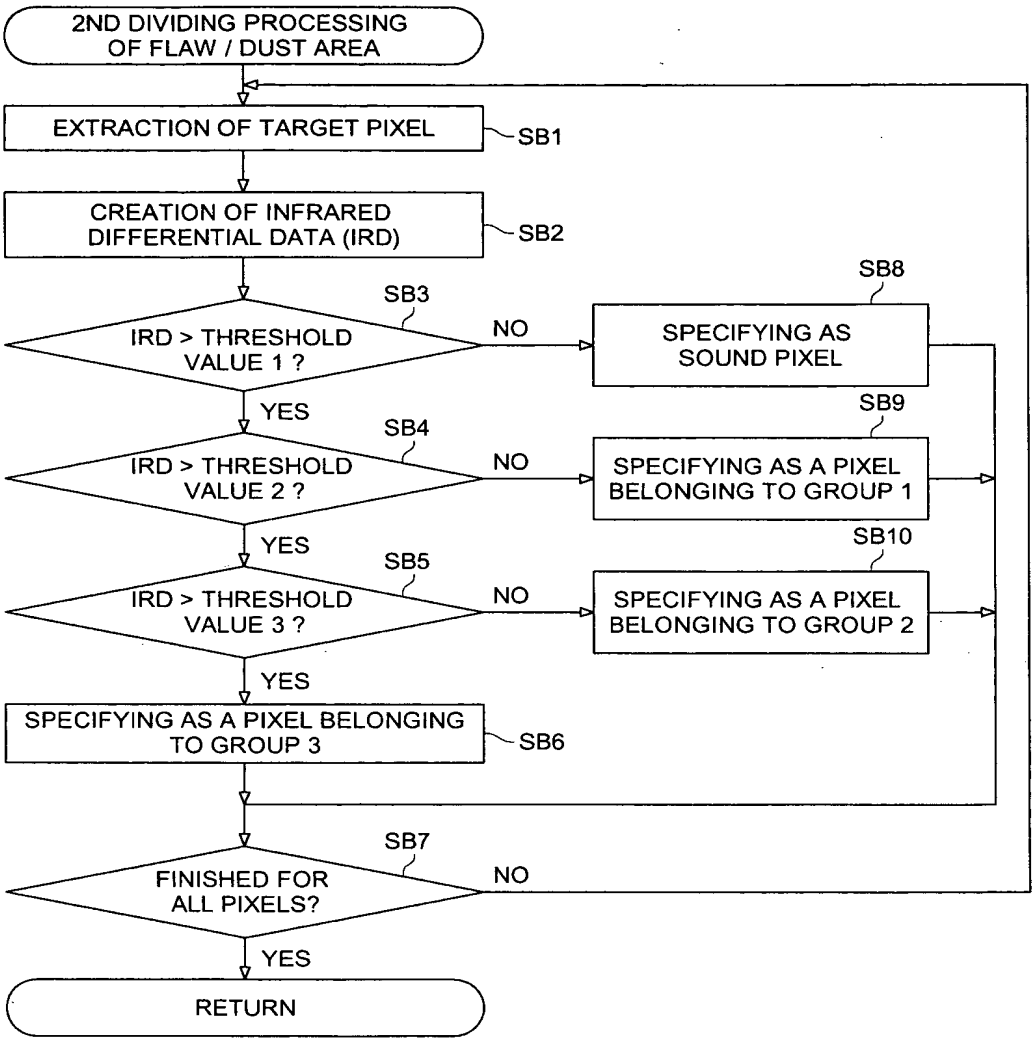
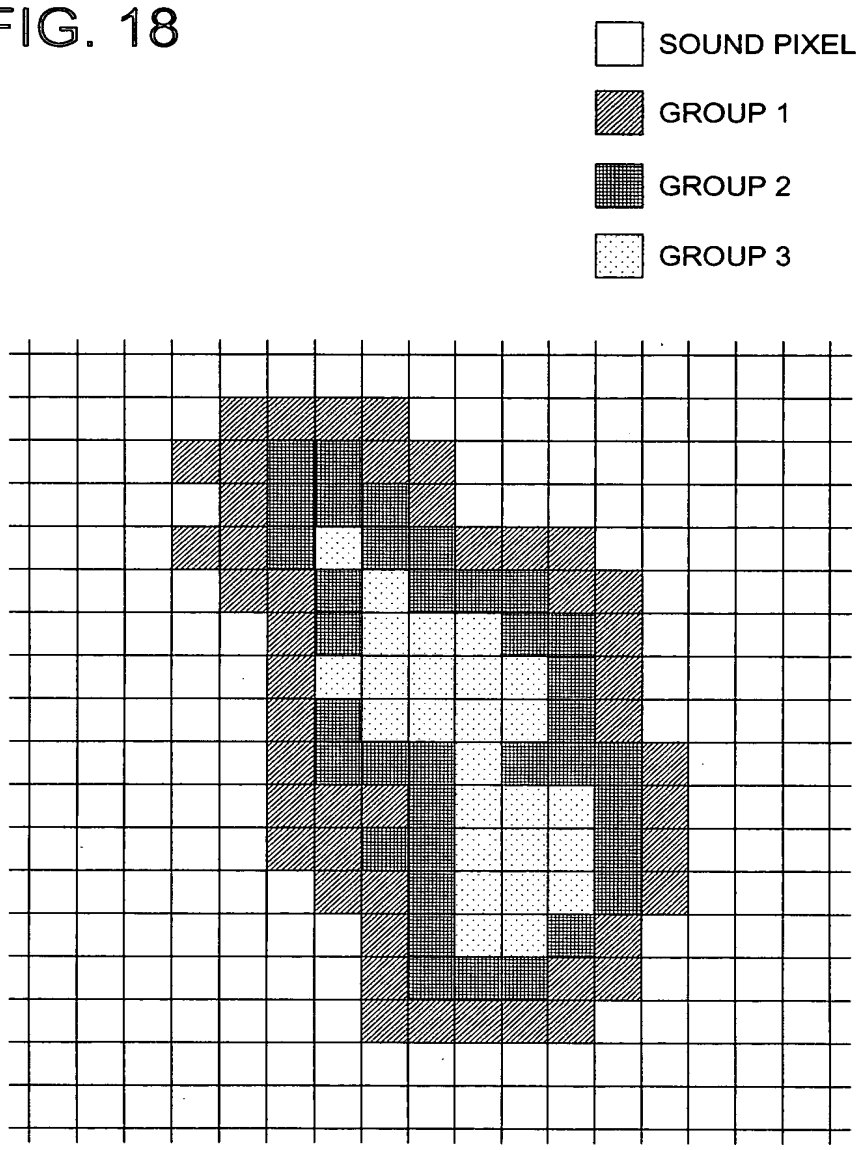

2ND DIVIDING PROCESSING OF FLAW / DUST AREA
EXTRACTION OF TARGET PIXEL
SB1
CREATION OF INFRARED DIFFERENTIAL DATA (IRD)
SB2
SB3
IRD > THRESHOLD VALUE 1 ?
NO
SB8
SPECIFYING AS SOUND PIXEL
YES
SB4
IRD > THRESHOLD VALUE 2 ?
NO
SB9
SPECIFYING AS A PIXEL BELONGING TO GROUP 1
YES
SB5
IRD > THRESHOLD VALUE 3 ?
NO
SB10
SPECIFYING AS A PIXEL BELONGING TO GROUP 2
YES
SPECIFYING AS A PIXEL BELONGING TO GROUP 3
SB6
SB7
FINISHED FOR ALL PIXELS?
NO
YES
RETURN

FIG. 18



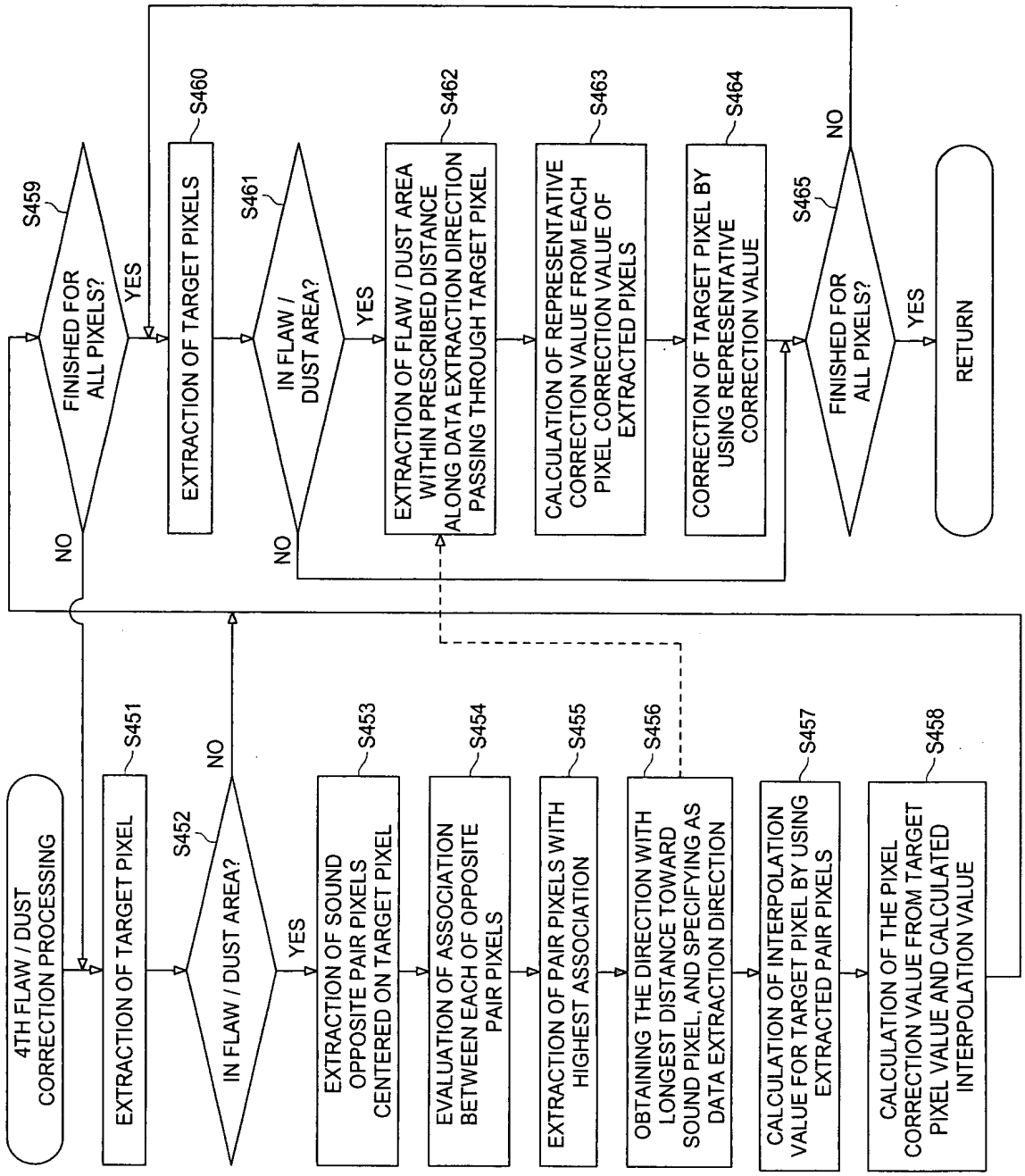

4TH FLAW / DUST CORRECTION PROCESSING
EXTRACTION OF TARGET PIXEL
S451
IN FLAW / DUST AREA?
S452
YES
NO
EXTRACTION OF SOUND OPPOSITE PAIR PIXELS CENTERED ON TARGET PIXEL
S453
EVALUATION OF ASSOCIATION BETWEEN EACH OF OPPOSITE PAIR PIXELS
S454
EXTRACTION OF PAIR PIXELS WITH HIGHEST ASSOCIATION
S455
OBTAINING THE DIRECTION WITH LONGEST DISTANCE TOWARD SOUND PIXEL, AND SPECIFYING AS DATA EXTRACTION DIRECTION
S456
CALCULATION OF INTERPOLATION VALUE FOR TARGET PIXEL BY USING EXTRACTED PAIR PIXELS
S457
CALCULATION OF THE PIXEL CORRECTION VALUE FROM TARGET PIXEL VALUE AND CALCULATED INTERPOLATION VALUE
S458
FINISHED FOR ALL PIXELS?
S459
YES
NO
EXTRACTION OF TARGET PIXELS
S460
IN FLAW / DUST AREA?
S461
YES
NO
EXTRACTION OF FLAW / DUST AREA WITHIN PRESCRIBED DISTANCE ALONG DATA EXTRACTION DIRECTION PASSING THROUGH TARGET PIXEL
S462
CALCULATION OF REPRESENTATIVE CORRECTION VALUE FROM EACH PIXEL CORRECTION VALUE OF EXTRACTED PIXELS
S463
CORRECTION OF TARGET PIXEL BY USING REPRESENTATIVE CORRECTION VALUE
S464
FINISHED FOR ALL PIXELS?
S465
YES
NO
RETURN

FIG. 19

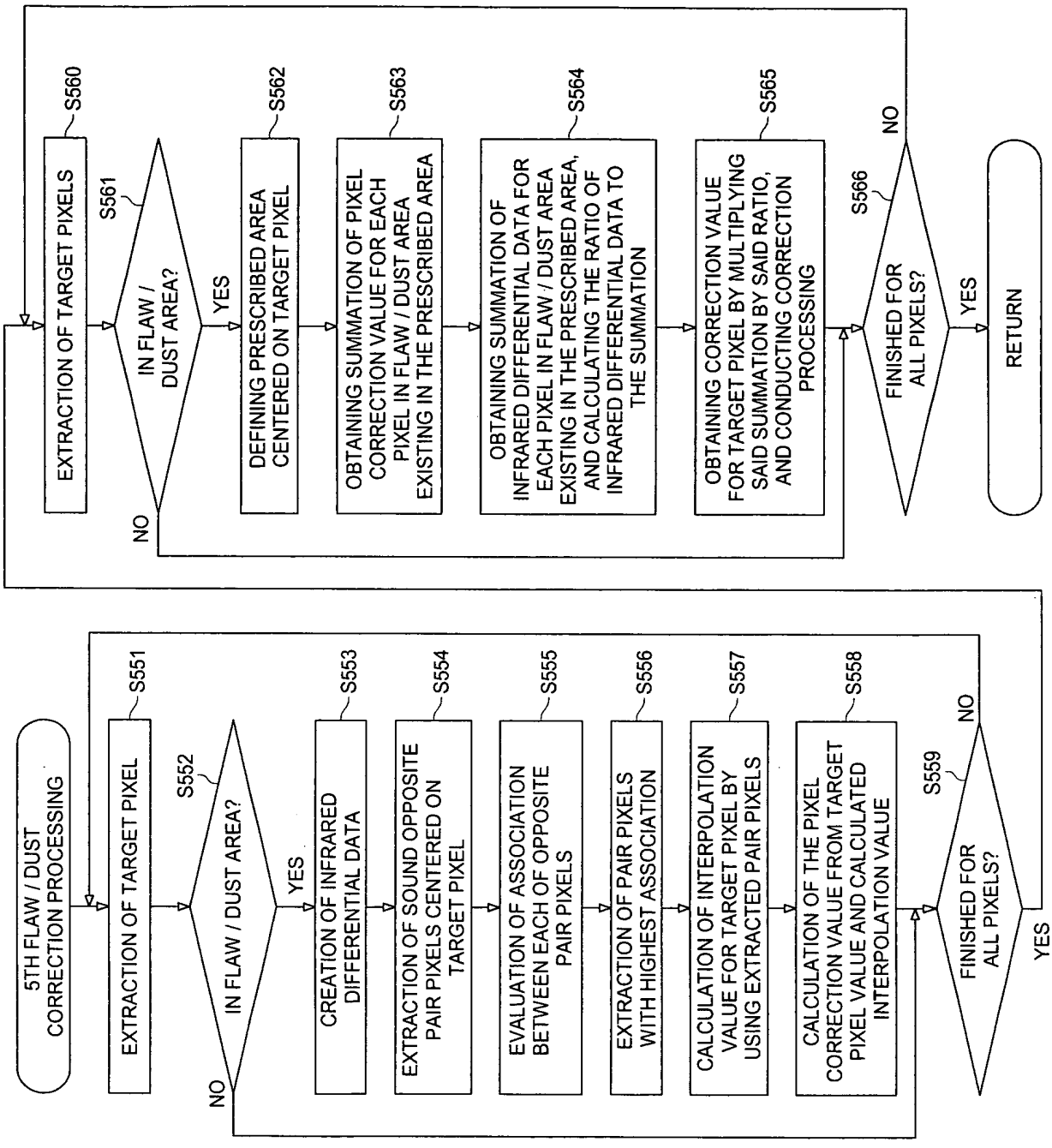

5TH FLAW / DUST CORRECTION PROCESSING
S551
EXTRACTION OF TARGET PIXEL
S552
IN FLAW / DUST AREA?
NO
YES
S553
CREATION OF INFRARED DIFFERENTIAL DATA
S554
EXTRACTION OF SOUND OPPOSITE PAIR PIXELS CENTERED ON TARGET PIXEL
S555
EVALUATION OF ASSOCIATION BETWEEN EACH OF OPPOSITE PAIR PIXELS
S556
EXTRACTION OF PAIR PIXELS WITH HIGHEST ASSOCIATION
S557
CALCULATION OF INTERPOLATION VALUE FOR TARGET PIXEL BY USING EXTRACTED PAIR PIXELS
S558
CALCULATION OF THE PIXEL CORRECTION VALUE FROM TARGET PIXEL VALUE AND CALCULATED INTERPOLATION VALUE
S559
FINISHED FOR ALL PIXELS?
NO
YES
S560
EXTRACTION OF TARGET PIXELS
S561
IN FLAW / DUST AREA?
NO
YES
S562
DEFINING PRESCRIBED AREA CENTERED ON TARGET PIXEL
S563
OBTAINING SUMMATION OF PIXEL CORRECTION VALUE FOR EACH PIXEL IN FLAW / DUST AREA EXISTING IN THE PRESCRIBED AREA
S564
OBTAINING SUMMATION OF INFRARED DIFFERENTIAL DATA FOR EACH PIXEL IN FLAW / DUST AREA EXISTING IN THE PRESCRIBED AREA, AND CALCULATING THE RATIO OF INFRARED DIFFERENTIAL DATA TO THE SUMMATION
S565
OBTAINING CORRECTION VALUE FOR TARGET PIXEL BY MULTIPLYING SAID SUMMATION BY SAID RATIO, AND CONDUCTING CORRECTION PROCESSING
S566
FINISHED FOR ALL PIXELS?
NO
YES
RETURN

FIG. 20

FIG. 21

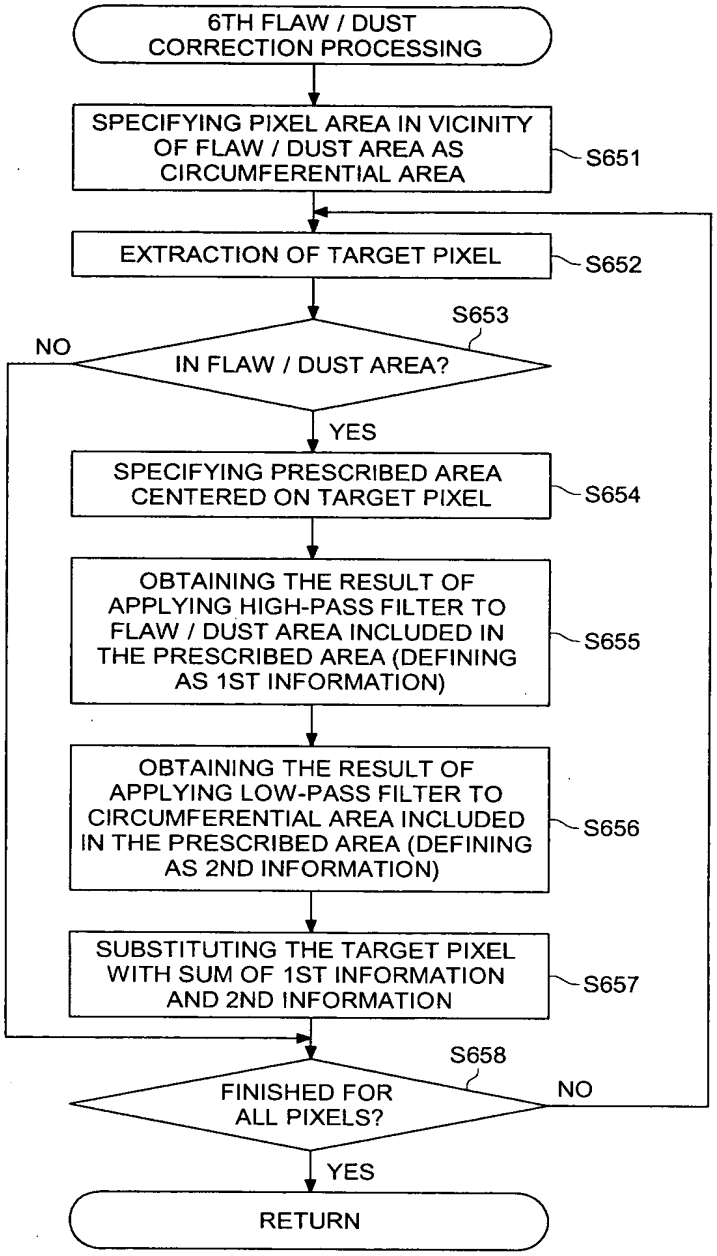

6TH FLAW / DUST CORRECTION PROCESSING
SPECIFYING PIXEL AREA IN VICINITY OF FLAW / DUST AREA AS CIRCUMFERENTIAL AREA
S651
EXTRACTION OF TARGET PIXEL
S652
S653
NO
IN FLAW / DUST AREA?
YES
SPECIFYING PRESCRIBED AREA CENTERED ON TARGET PIXEL
S654
OBTAINING THE RESULT OF APPLYING HIGH-PASS FILTER TO FLAW / DUST AREA INCLUDED IN THE PRESCRIBED AREA (DEFINING AS 1ST INFORMATION)
S655
OBTAINING THE RESULT OF APPLYING LOW-PASS FILTER TO CIRCUMFERENTIAL AREA INCLUDED IN THE PRESCRIBED AREA (DEFINING AS 2ND INFORMATION)
S656
SUBSTITUTING THE TARGET PIXEL WITH SUM OF 1ST INFORMATION AND 2ND INFORMATION
S657
S658
FINISHED FOR ALL PIXELS?
NO
YES
RETURN

FIG. 22

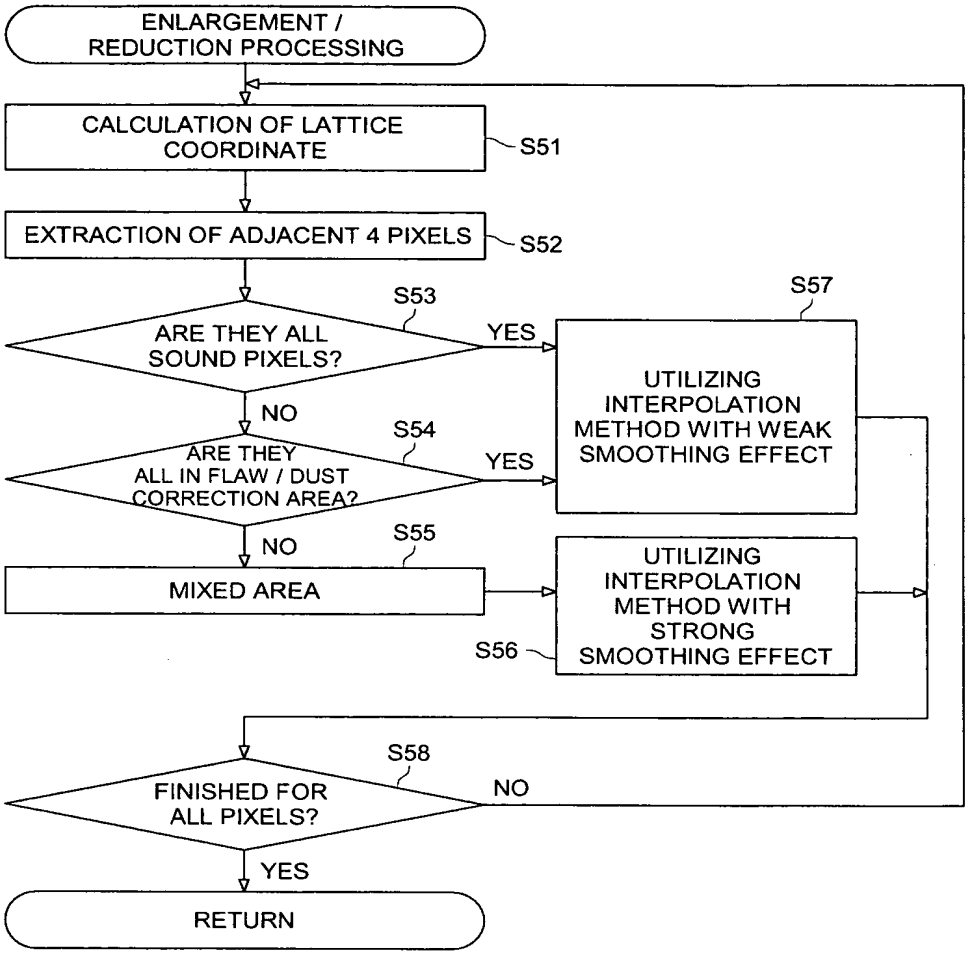

ENLARGEMENT / REDUCTION PROCESSING
CALCULATION OF LATTICE COORDINATE
S51
EXTRACTION OF ADJACENT 4 PIXELS
S52
S53
ARE THEY ALL SOUND PIXELS?
YES
S57
UTILIZING INTERPOLATION METHOD WITH WEAK SMOOTHING EFFECT
NO
S54
ARE THEY ALL IN FLAW / DUST CORRECTION AREA?
YES
NO
S55
MIXED AREA
S56
UTILIZING INTERPOLATION METHOD WITH STRONG SMOOTHING EFFECT
S58
FINISHED FOR ALL PIXELS?
NO
YES
RETURN

FIG. 23

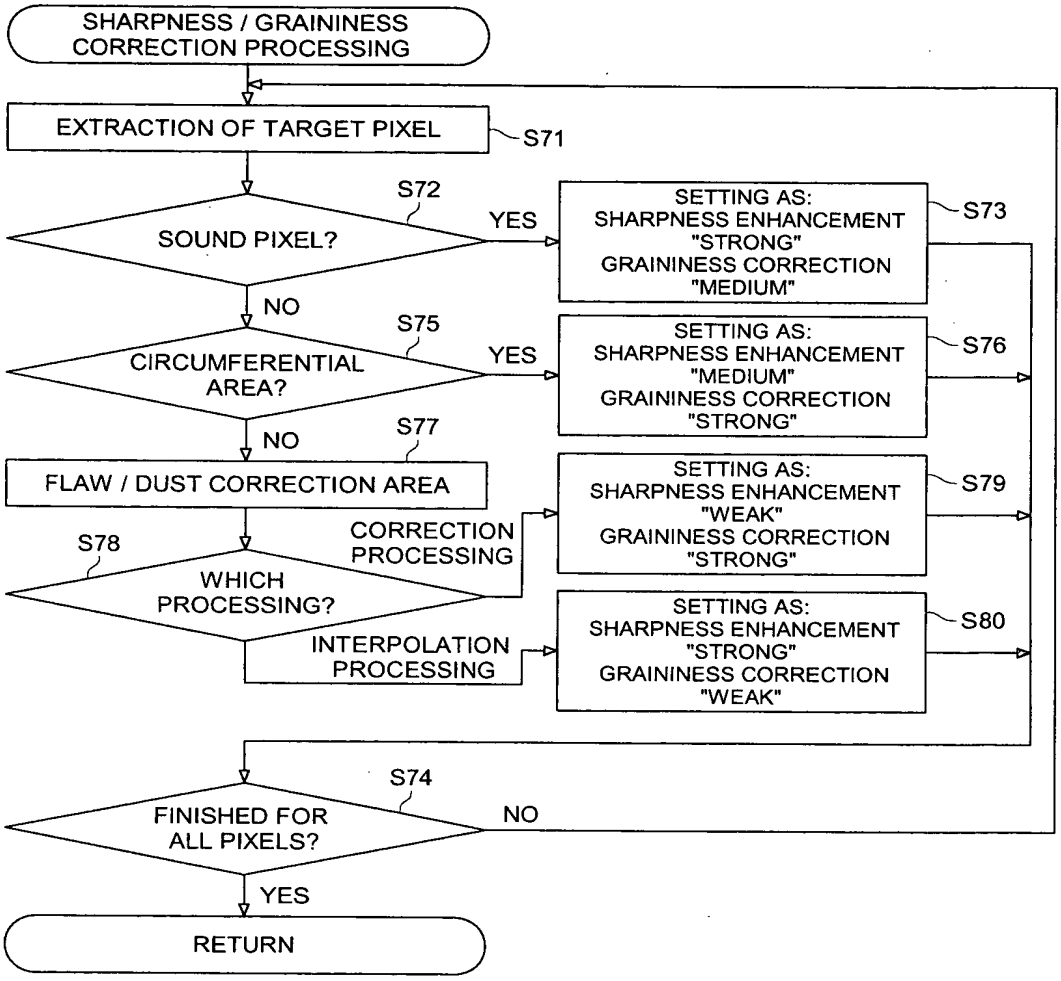
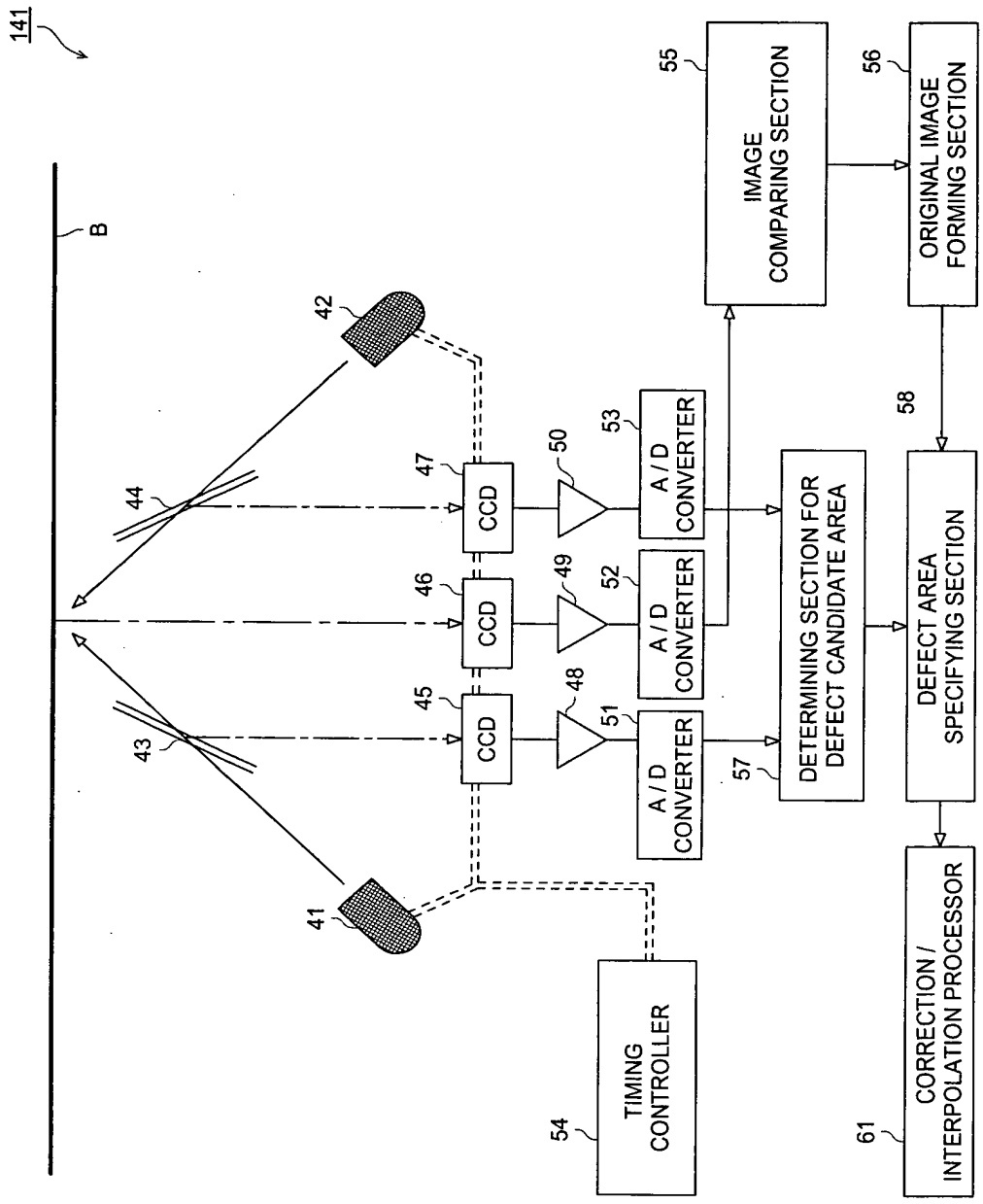

SHARPNESS / GRAININESS CORRECTION PROCESSING
EXTRACTION OF TARGET PIXEL
S71
S72
SOUND PIXEL?
YES
SETTING AS: SHARPNESS ENHANCEMENT "STRONG" GRAININESS CORRECTION "MEDIUM"
S73
NO
S75
CIRCUMFERENTIAL AREA?
YES
SETTING AS: SHARPNESS ENHANCEMENT "MEDIUM" GRAININESS CORRECTION "STRONG"
S76
NO
S77
FLAW / DUST CORRECTION AREA
S78
WHICH PROCESSING?
CORRECTION PROCESSING
SETTING AS: SHARPNESS ENHANCEMENT "WEAK" GRAININESS CORRECTION "STRONG"
S79
INTERPOLATION PROCESSING
SETTING AS: SHARPNESS ENHANCEMENT "STRONG" GRAININESS CORRECTION "WEAK"
S80
S74
FINISHED FOR ALL PIXELS?
NO
YES
RETURN

FIG. 24


141
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CCD
CCD
CCD
A/D CONVERTER
A/D CONVERTER
A/D CONVERTER
54
TIMING CONTROLLER
55
IMAGE COMPARING SECTION
56
ORIGINAL IMAGE FORMING SECTION
57
DETERMINING SECTION FOR DEFECT CANDIDATE AREA
58
DEFECT AREA SPECIFYING SECTION
61
CORRECTION / INTERPOLATION PROCESSOR